



## First record of Wild Boar (*Sus scrofa* Linnaeus, 1758) in Lençóis Maranhenses National Park, Maranhão state, northern Brazil

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### Abstract

The Wild Boar is one of the world's most dangerous invasive species. It is now established in many regions beyond its native range, including many Brazilian states. However, the species has never been recorded from the Brazilian state of Maranhão. Here, we report the first occurrence of this species from Lençóis Maranhenses National Park, within the municipality of Barrerinhos, Maranhão state. We discuss the negative effects of this introduction on native species, including the problem with predation of nests of an endangered turtle species by Wild Boar.

### Keywords

Biological invasions, Brazilian National Park, invasive species, predation.

**Academic editor:** Átila Colombo Ferreguetti | Received 2 March 2019 | Accepted 3 August 2019 | Published 18 October 2019

**Citation:** Salvador GN, Ristau NG, Silva IS, Nunes AV (2019) First record of Wild Boar (*Sus scrofa* Linnaeus, 1758) in Lençóis Maranhenses National Park, Maranhão state, northern Brazil. Check List 15 (5): 915–919. <https://doi.org/10.15560/15.5.915>

### Introduction

The Wild Boar, *Sus scrofa* Linnaeus, 1758, has been introduced around the world as an alternative source of protein for humans (Sjarmidi and Gerard 1988, Barrios-Garcia and Ballari 2012). Through both deliberate and accidental release, this species has become established in the wild, and today it can be found in many countries beyond its native range (Mayer and Brisbin 2008, Barrios-Garcia and Ballari 2012). Substantial records exist of introductions in sub-Saharan Africa, Oceania, and the Americas, with this species only absent on the Antarctic continent (Barrios-Garcia and Ballari 2012). In the Neotropical region, Wild Boar is highly invasive (Sales et al. 2017), with occurrences in all South American countries

except for the Guianas (Herrero and de Luco 2003, Cuevas et al. 2010, Barrios-Garcia and Ballari 2012, Burgos-Paz et al. 2013, Skewes and Jaksic 2015).

The oldest record of Wild Boar in Brazil, in 1989, was in Jaraguão county, Rio Grande do Sul state (Deberdt and Scherer 2007), which can be considered the first introduction cycle of boar in Brazil (Oliveira 2012). Since that time, wild boars (*S. scrofa* and *S. scrofa domesticus* Erxleben, 1777 × *S. scrofa*) have been recorded in the Brazilian regions of the South, Southeast, and Center-West regions (Deberdt and Scherer 2007, Trovati and Munerato 2013, Pedrosa et al. 2015, Pereira et al. 2018, Silveira and Pacheco 2018). It also occurs in six municipalities of Bahia state, where the northernmost Brazilian record was

observed in Correntina (Pedrosa et al. 2015). Although populations of Wild Boar are now throughout the country, there are still no records from northern and many north-eastern states. Here, we provide the first record of Wild Boar in the northeastern Brazilian state of Maranhão.

## Methods

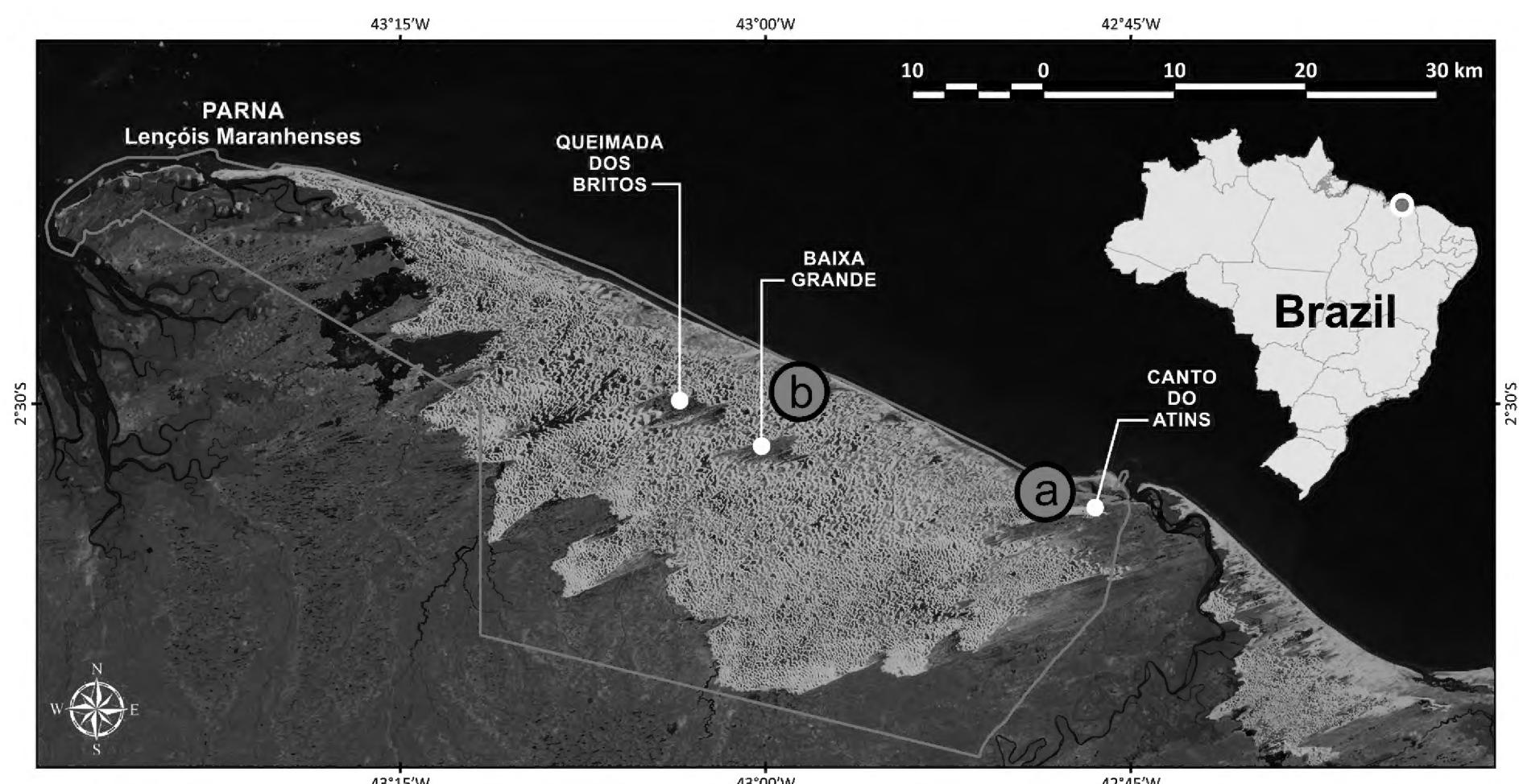
The records were taken during the stranding monitoring of Testudines and aquatic mammals conducted by Instituto Amares in Lençóis Maranhenses National Park (LMNP) (Fig. 1). The LMNP has a total area of 155,000 ha which is inserted into a transition area between the Amazon, Brazilian Savana, and Caatinga biomes. It is composed of restinga habitats (coastal and dune scrub-lands) (Miranda et al. 2012), and its landscape is dominated by dunes and seasonal freshwater ponds formed

during the rainy season. Photographic records were made using a Canon 100-400 mm telephoto lens. The photographed specimens were identified using Reis et al. (2006) as resource.

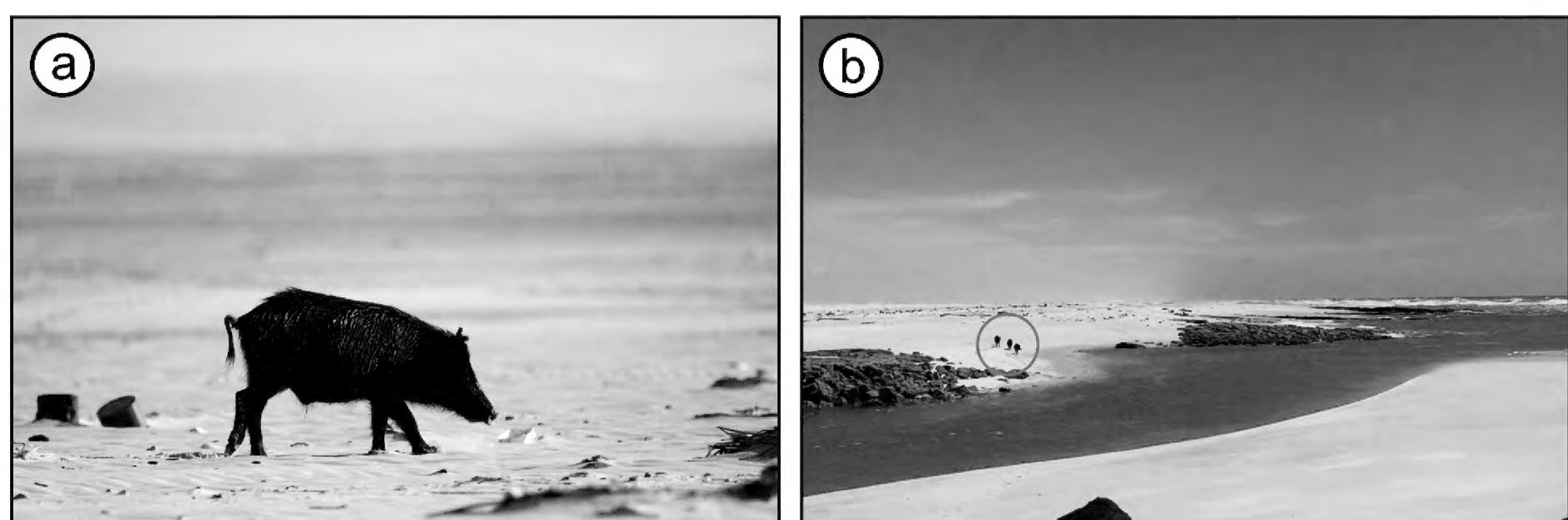
## Results

**New records.** Brazil: Maranhão state: municipality of Barreirinhas: Lençóis Maranhenses National Park ( $02^{\circ}32'10"S$ ,  $042^{\circ}51'44"W$ ), on a beach, July 2016, obs. by G. N. Salvador, 3 individuals (Fig. 2A). Ibid., ( $02^{\circ}29'21"S$ ,  $042^{\circ}57'36"W$ ), 12 km from the previous record, June 2017, obs. by N. G. Ristau and I. S. Silva, 3 individuals (Fig. 2B).

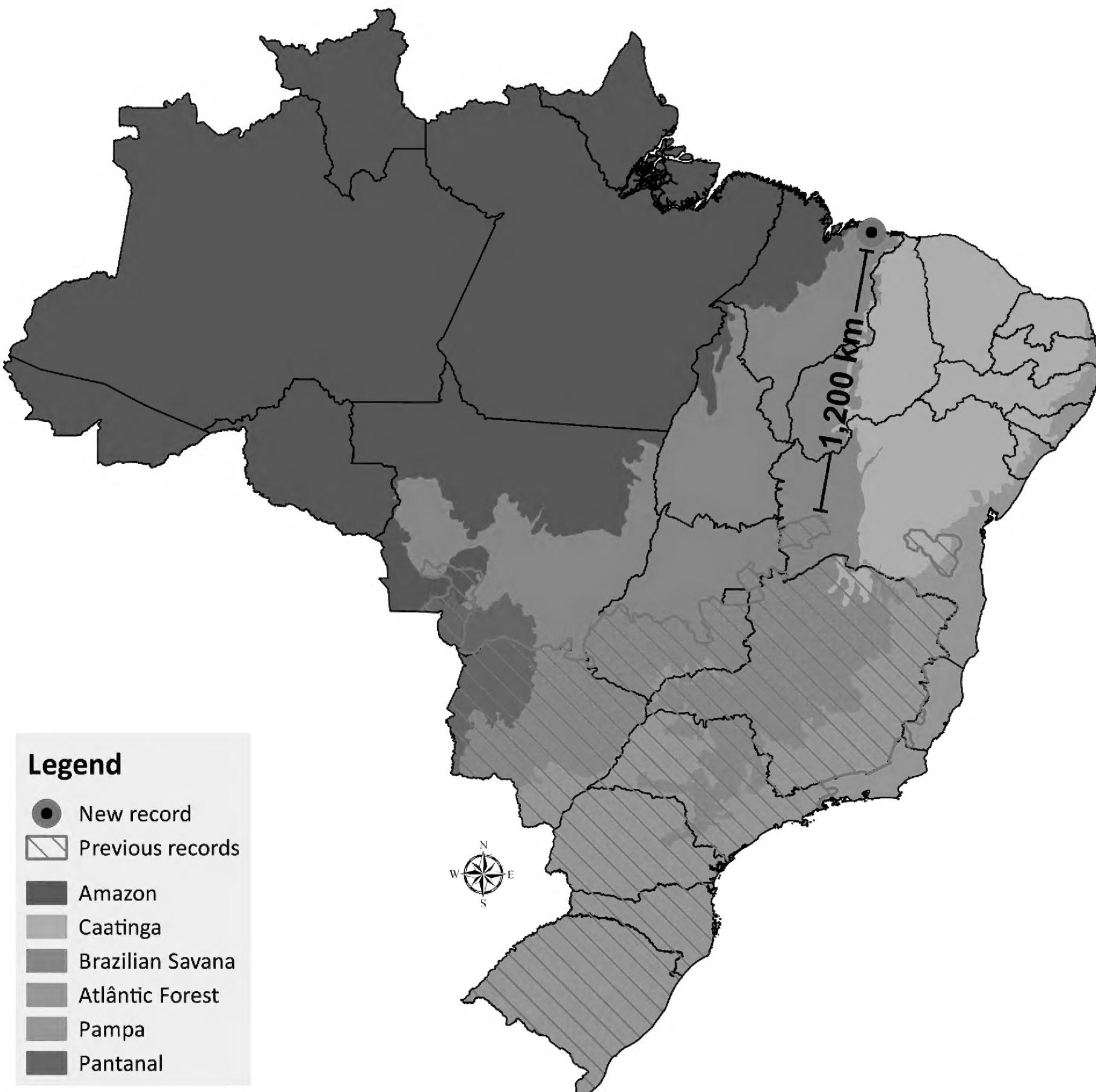
These records are approximately 1,200 km from the nearest known record, which was in the municipality of Correntina, state of Bahia (Fig. 3).



**Figure 1.** Map of boundaries of Lençóis Maranhenses National Park showing wild boar record site (orange dots: record from July 2016 = a; record from June 2017 = b) and the principal communities inside the park (white dots). The red dot inside of the map of Brazil represent the locality of Lençóis Maranhenses National Park. The map was generated by QGIS program, using Landsat 8 images in true color pattern (4-3-2).



**Figure 2.** Wild Boar photographed in Lençóis Maranhenses National Park, Maranhão state, Brazil. **A.** One specimen photographed on July 2016 in a beach of the LMNP. **B.** Three individuals photographed on June 2017 crossing the Rio Preto (red circle), the only river that crosses the LMNP.



**Figure 3.** Brazilian map showing the new record site of wild boar in Maranhão and its known distribution. Adapted from Pedrosa et al. (2015).

**Identification.** Wild Boar is easily identified from Brazilian native pigs by the pelage colour. The specimens recorded in LMNP had entirely black pelage without white marks (Fig. 2a). White-lipped Peccary, *Tayassu pecari* (Link, 1795), can be identified by its light stripe along the length of the jaw, while Collared Peccary, *Pecari tajacu* (Linnaeus, 1758), can be identified by the white collar that extends obliquely over the neck (Reis et al. 2006).

## Discussion

Wild Boar is a damaging invasive species in many Brazilian states (Pedrosa et al. 2015). Its spread into LMNP might be due to two possible vectors. This species might have reached LMNP by natural dispersion north from Bahia. However, the great distance between

Barreirinhas county in Maranhão and Correntina county in Bahia makes this hypothesis less likely. Alternatively, Wild Boar might have been introduced to the LMNP by people living in the local communities. In LMNP, there are local human settlements despite the ongoing processes of expropriation. In all of these communities there is livestock and at least 11 reports of boars or razorbacks (N.G. Ristau pers. obs.). Animals run free due to the struggles by low-income families to feed and maintain livestock in captivity. This increases the likelihood of the establishment of feral populations of boars (Morelle et al. 2016). In summary, the new record reinforces the assumption that the distribution of Wild Boar is facilitated by humans (Tabak et al. 2017).

The presence of traditional communities inside protected areas, such as national parks in Brazil, is common. Due to the lack of financial investment in nature

conservation, the creation of reserves often runs up against land issues. An alternative of temporary management was to maintain the Wild Boar populations confined in these traditional communities. It is acceptable that traditional communities, such as local fishermen as well as indigenous, and quilombola people, remain in their original territory in order to maintain their traditions and culture. However, the Brazilian government needs to assist these communities by providing information about the management of non-native species, like Wild Boar.

One of the local impacts of Wild Boar is the predation of the nests of *Trachemys adiutrix* Vanzolini, 1995, a turtle which is locally called the “pininga” (N.G. Ristau pers. comm.). This species, which inhabits ponds and dunes, is endemic to coasts of Maranhão and Piauí states in Brazil (Vanzolini 1995). It is classified as Endangered (B1+2c) according to the Tortoise & Freshwater Turtle Specialist Group (1996). There are also indications of predation of the nests of two species of sea turtles in LMNP: Olive Ridley Sea Turtle, *Lepidochelys olivacea* (Eschscholtz, 1829) and Hawksbill Sea Turtle, *Eretmochelys imbricata* (Linnaeus, 1766). Both are threatened species, with *L. olivacea* classified as Vulnerable (A2bd) and *E. imbricata* as Critically Endangered (A2bd) (Abreu-Grobis and Plotkin 2008, Mortimer and Donnelly 2008). In addition to the Testudines (turtles), several species of bird lay their eggs on the dunes and restingas of the LMNP and are vulnerable to nest predation by Wild Boars. Nest predation behavior in Wild Boar has already been observed in Australia (Whytlaw et al. 2013) and can have deleterious effects on local bird populations.

Mammals such as the native Collared Peccary, which occurs in the LMNP (IBAMA 2003), is another species that may suffer negative effects from interactions with the boar. Although there is no reported niche overlap between boars and the two native pig species (Collared Peccary and White-lipped Peccary) in the Pantanal (Desbiez et al. 2009), it remains unclear whether this is the case in other Brazilian biomes.

There is a normative instruction (03/2013) from the Brazilian environmental agency, Instituto Brasileiro do Meio Ambiente e dos Recursos Naturais Renováveis (IBAMA) authorizing the species control through hunting (IBAMA 2013). Moreover, there is a National Wild Pig Control Plan under development, which aims to control the territorial expansion of this species and mitigate possible environmental impacts (da Rosa et al. 2017). However, information on range, population density, and impacts of Wild Boar on other species and habitats is scarce. Characteristics of this species, such as high reproduction success, broad dispersal capacity, and generalized feeding habits, allow for a rapid adaptation to diverse environments, and makes the control of Wild Boar extremely complex and difficult (Sales et al. 2017). In general, the risks posed by Wild Boar towards other species are unknown and even neglected by breeders,

who prioritize the increase or maintenance of their drove of boars opposed to the protection of wild species. This is due mainly to the difficulties to obtaining food resources in regions such as dunes and restingas inside the LMNP, especially during dry season, when there is no rain during at least six months.

Due to the distance from the current record to the previous records of the species and impacts on tortoise, some questions become pertinent. What is the density of Wild Boar in the LMNP? What are the preferred habitats used by this species? How long has this species been in the region? Is there an established population or only a few individuals? What is the effect of this species’ introduction on wild species? What is the nutritional importance of this species in the diets of traditional communities? Answers to these questions are essential for the mitigation and management of this species in natural areas and for choosing the best method for population estimation and eventual control (see Engeman et al. 2013). Finally, the presence of Wild Boar within a protected area represents a significant threat to local biodiversity. The way that the responsible agency (*Chico Mendes Institute* for Biodiversity Conservation) was entirely bypassed in the process of Wild Boar introductions and management of the traditional communities inside the park, highlights how delineating protected areas must occur in tandem with strict enforcement of regulations and monitoring programs for nature to truly benefit.

## Acknowledgements

We thank CGG, the company that implemented and funding the beach monitoring plan (BMP), which originated the record. We also thank the CGPEG/IBAMA, which is responsible for the legal regulation of the BMP. We thank our colleagues Adriano Damato, manager of the Lençóis Maranhenses National Park at the time of our study, Prof. Luiz Gustavo who helped us identify the specimens, and Renata G. Frederico, Cindy Coyle, Sophia Pontes, and Rafael Thome for their help with the translation of our manuscript. This work was supported (scholarship grant to GNS) by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior (CAPES) and the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) (grant number: 300657/2019-6 to AVN).

## Authors' Contributions

GNS, NGR, and ISS recorded the species, GNS and AVN identified the species, GNS wrote the manuscript, and GNS, NGR, ISS, and AVN reviewed the text.

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